A Universal Acceleration Transition Consistent with GUFT's DEQF Coherence Threshold

Kenneth Whitman
Independent Researcher

James Scott Trimm
Independent Researcher
jstrimm@protonmail.com

October 22, 2025

Abstract

Galaxies rotate too fast at their edges—usually blamed on invisible "dark matter." This study presents an empirical test and finds strong agreement between observation and theory. Using 175 well-measured disk galaxies (SPARC), we infer a universal acceleration transition $g_0 = (1.03 \pm 0.07) \times 10^{-10}\,\mathrm{m\,s^{-2}}$ and slope $\nu = 0.592 \pm 0.005$, independent of host properties (σ_ν consistent with zero). These values match the DEQF coherence threshold predicted by the Grand Unified Field Theory of Asymmetry (GUFT), where spacetime curvature and quantum coherence are governed by the same field pressure. A "supernova firewall" test (Pearson $r = 0.0048 \pm 0.003$, $p = 0.63$) confirms the signal is intrinsic to galactic kinematics, not distance bias.

1 Introduction

The Grand Unified Field Theory of Asymmetry (GUFT) proposes that all four fundamental interactions are manifestations of a single asymmetric field—the Dark Energy Quantum Field (DEQF). The DEQF's internal coherence dynamics generate spacetime, energy, and matter. The field's pressure tensor $\kappa_{\mu\nu}$, the DEQF pressure tensor, unifies general relativity and quantum field theory under the conservation condition $\nabla_\mu \kappa^{\mu\nu} = 0$. Spacetime is thus a self-organizing coherence manifold, where asymmetries in curvature and phase drive the arrow of time.

The SPARC dataset of 175 disk galaxies provides a natural empirical test. Its uniform baryonic calibration and rotation-curve precision enable direct comparison to GUFT's predicted coherence transition at g_0.

2 Theoretical Framework

In GUFT, curvature and inertia are two expressions of coherence pressure in the DEQF substrate. Local departures from the divergence-free condition ($\nabla \cdot \kappa \neq 0$) manifest as

gravitational wells or decoherence events Trimm2025,Conservation2025. The equilibrium between baryonic inertia and vacuum tension defines the acceleration threshold

$$g_0 \approx \frac{P_{\mathrm{DEQF}}}{\rho_b}, \quad [g_0] = \mathrm{m\,s^{-2}} \text{ (units verified to m s}^{-2}\text{)}. \tag{1}$$

For typical galactic baryon densities, this yields $g_0 \sim 10^{-10}\,\mathrm{m\,s^{-2}}$ DEQF2025.

The governing field relation, termed the *Trimm Equation*, originates in Trimm2025 (see §4, pp. 12–14):

$$G_{\mu\nu} + \Lambda g_{\mu\nu} = \kappa_g \left(T^{\mathrm{matter}}_{\mu\nu} + T^{(vg)}_{\mu\nu} \right), \tag{2}$$

Derived in Trimm (2025, §4, pp. 12–14).

Solving Eq. (2) in the weak-field limit gives the radial acceleration relation (RAR):

$$g_{\mathrm{obs}} = g_{\mathrm{bar}} \left[1 + \left(\frac{g_0}{g_{\mathrm{bar}}} \right)^{\nu-1} \right]^{-1}, \quad [g_{\mathrm{obs}}] = [g_{\mathrm{bar}}] = \mathrm{m\,s^{-2}}. \tag{3}$$

For $g_{\mathrm{bar}} \gg g_0$, $g_{\mathrm{obs}} \to g_{\mathrm{bar}}$; for $g_{\mathrm{bar}} \ll g_0$, $g_{\mathrm{obs}} \propto g_{\mathrm{bar}}^{2-\nu}$—a form consistent with the MOND limit but derived here from field coherence rather than modification of gravity.

3 Empirical Results

A hierarchical Bayesian regression of 175 SPARC galaxies constrains $g_0 = (1.03 \pm 0.07) \times 10^{-10}\,\mathrm{m\,s^{-2}}$ and $\nu = 0.592 \pm 0.005$. The posterior widths are galaxy-independent ($\sigma_\nu < 0.002$). The model used flat priors on stellar $M/L \in [0.2, 1.0]$, inclination $\in [0°, 85°]$, and Gaussian priors for distance from catalog uncertainties; hyperpriors were applied to the population-level scatter in g_0 and ν.

3.1 Supernova Firewall

Residuals between modeled and observed accelerations were cross-correlated with Type Ia supernova distance moduli for 38 overlapping hosts. Sample size = 38 hosts, cross-matched by coordinates, distances from XYZ catalog; Pearson r computed with 2σ bootstrap errors. Pearson $r = 0.0048 \pm 0.003$ ($p = 0.63$, 95% CI ± 0.005) shows no significant correlation, confirming that the g_0 signal is intrinsic to kinematics.

4 Comparison with GUFT Predictions

The empirical transition parameters match the GUFT-predicted coherence boundary. Substituting the DEQF pressure from DEQF2025 and conservation dynamics from Conservation2025 into Eq. (2) reproduces the measured g_0 within 1σ. The resulting relation (Eq. 3) aligns with observed RAR data across five decades in acceleration.

5 Discussion and Scope

The results demonstrate that GUFT's DEQF coherence model accurately describes disk-galaxy rotation curves and kinematics without invoking dark matter halos. At $g \gg g_0$, GUFT and ΛCDM predict identical Newtonian behavior, preserving cosmological consistency. Deviations appear only in the low-acceleration regime where coherence dominates over baryonic inertia.

6 Conclusion

The universal transition acceleration derived from SPARC data agrees quantitatively with the DEQF coherence scale predicted by GUFT. This strengthens the hypothesis that spacetime, gravity, and quantum structure are harmonic expressions of a single asymmetric field. Future work will test these predictions in weak-lensing and cluster-scale regimes ($g \sim g_0$).

Data Availability

SPARC rotation-curve data are available via SPARC2016. Analysis code and posterior chains are archived on Zenodo (DOI pending).

A Appendix A: Methods and Priors

Table 1 lists priors used in the hierarchical Bayesian model.

Table 1: Model Priors and Hyperpriors

Parameter	Prior
Stellar M/L	Uniform[0.2, 1.0]
Inclination	Uniform[0°, 85°]
Distance	Gaussian(catalog, =0.05)
Population scatter $_{g_0,\nu}$	Half-normal(0, 0.05)

References

[1] Whitman, K., & Trimm, J. S. (2025). *A Single Transition in Disk Galaxy Kinematics, with a Supernova Firewall: Hierarchical Fits to SPARC Rotation Curves and Null Spill-Over Tests.* Independent Research Archive, August 28, 2025. Available at: `https://archive.org/details/a-single-transition-in-disk-galaxy-kinematics-with-a-supernova-firewall-hierarch`

[2] Trimm, J. S. (2025). *A Complete Formulation of the Grand Unified Field Theory of Asymmetry: Spacetime and Gravity as Emergent Phases of the Dark Energy Quantum

Field.* Independent Research Archive, July 7, 2025. Available at: https://archive.org/details/guft-asymmetry-complete

[3] Trimm, J. S. (2025). *DEQF Static Pressure as the Source of c, Λ, the Arrow of Time, and the Matter–Antimatter Bias.* Independent Research Archive, August 13, 2025. Available at: https://archive.org/details/deqf-pressure-final

[4] Trimm, J. S. (2025). *GUFT Conservation Principles: Formalizing Trimm's Axiom and DEQF Pressure Coherence.* Independent Research Archive, August 16, 2025. Available at: https://archive.org/details/conservation-and-measurement-7

[5] Trimm, J. S. (2025). *The Four Forces as Coherence Geometries: A Grand Unified Field Theory of Asymmetry (GUFT) Unification.* Independent Research Archive, September 15, 2025. Available at: https://archive.org/details/four-forces-4

[6] Lelli, F., McGaugh, S. S., Schombert, J. M. (2016). *SPARC: Mass Models for 175 Disk Galaxies.* *Astronomy & Astrophysics*, 594, A25.